RELAP5-3D Gas-Cooled Reactor Activities

Paul D. Bayless

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Overview

- High Temperature Test Facility
- High Temperature Test Reactor
- Other

Why gas reactors?

- Operate at high coolant temperatures
  - Good for efficiency
  - Bad for pressure boundary materials
- Flexibility
  - Process heat
  - Electricity generation
  - Hybrid
- Inherent safety
- Smaller power rating (but large reactor vessels)

High Temperature Test Facility highlights

- Integral experiment being built at Oregon State University
- 2.2 MW electrically-heated, scaled model of a high temperature gas reactor
  - Reference is the Modular High-Temperature Gas-cooled Reactor (MHTGR) (prismatic blocks)
  - Large ceramic block representing core and reflectors
  - ¼ length scale
  - Prototypic coolant inlet (259°C) and outlet (687°C) temperatures
  - Less than scaled power
  - Maximum pressure of ~700 kPa
- Primary focus is on depressurized conduction cooldown transient

HTTF-related Code Activities

- Quality-assured input model development
- Supported facility design
- Operational support
  - Provided simulations of system heatup and cooldown behavior
  - Investigated possibility of stacking tests
- Input model benchmarking using system characterization data
- Code assessment using test data

High Temperature Engineering Test Reactor (HTTR)

- 30 MW prismatic block reactor in Japan
- Japan Atomic Energy Agency has a RELAP5/MOD3 input model
- Will be upgrading that model to RELAP5-3D
- Coupled RELAP5-3D/PHISICS model
- Code assessment using plant data
- Potential upgrades to some code component models

Other Gas-Cooled Reactors

- Several small commercial designs being proposed
- Demonstration and test reactors
- Pebble beds

Code Challenges

- Using models that have not been exercised much
- Developing and using new modeling techniques
- Little assessment under typical reactor conditions
- No idea how accurate the simulation results are

Code Development Activities

- Added capability to enter heat structure lengths on input
  - Normally defaults to volume length
  - Accommodates multiple (axial) structures connected to the same fluid volumes
  - Two-dimensional (axial) conduction model now available for structures with no volume connections
- Added temperature-dependent conductance option
  - Default option uses a constant conductance
  - General table type HTC-TEMP